UCDAVIS
INNOVATION & TECHNOLOGY
COMMERCIALIZATION

GREETINGS

FROM UC DAVIS

It is a pleasure to share with you our progress in advancing innovation, startup development and technology commercialization at UC Davis over the 2018–19 fiscal year—and the myriad ways these efforts are contributing to our community and society.

Over the past year, our engagement with the university's researchers and innovators has led to 164 patent applications, issuance of 98 patents, formation of 14 startup companies, execution of 55 license agreements and generation of over $10 million in gross patent revenue.*

As traditional "technology transfer" has evolved to keep pace with the realities of a changing capital environment, university spinoffs are increasingly seen by more established companies as the preferred vehicle for accessing university technologies due to their de-risking and commercial focus compared to direct licensing from academic institutions.

In keeping with this change, we launched the Venture Catalyst Biotech Innovation Gallery (BIG) Accelerator, which included a showcase event coinciding with the annual J.P. Morgan Healthcare Conference in San Francisco. In addition to providing an opportunity for our startups to engage directly with investors, an important contribution of the BIG Accelerator is linking startups to potential strategic partners through over 65 one-on-one meetings. You can read more about this accelerator and startup showcase in the following pages.

Some of you may have noted that the university division I've been leading for over seven years has a new name: Innovation and Technology Commercialization (ITC). Previously called Technology Management and Corporate Relations, we have since coalesced our divisional activities around companion units Innovation*Access* and Venture Catalyst as part of a high-level reorganization within the Office of Research. The Office of Corporate Relations has been replaced by a new blended Foundation and Corporate Engagement team within the UC Davis Development and Alumni Relations office, which reports to the vice chancellor for Development and Alumni Relations, the chief fundraiser for the university.

Our 2018–19 Annual Report provides an overview of our key programs, activities and related outcomes enabled by Innovation*Access* and Venture Catalyst. The vignettes within provide an in-depth view of some of our innovators, startups, cutting-edge technologies and pioneering programs.

On a final note, I recently announced my decision to take a new position outside of the university. I have thoroughly enjoyed my time working at UC Davis and consider the relationships that we have developed along the way to be instrumental in the success that we have shared. For that, I thank you and hope our paths remain connected.

As always, I encourage you to engage with our team to identify opportunities to reach your business and professional objectives.

Sincerely,

DUSHYANT PATHAK

Associate Vice Chancellor
Innovation & Technology Commercialization

Executive Director
Venture Catalyst

JANUARY 2012–SEPTEMBER 2019

*The values reported are preliminary estimates based on data at the time of publishing this report.

PROVIDING SOLUTIONS, CREATING JOBS AND

UNLOCKING OPPORTUNITIES

The University of California, Davis is transforming the world by advancing the frontiers of knowledge, educating the workforce of the future and translating research and technology into products and services that promote social impact in our region and around the planet. We enable synergies between the life sciences and physical sciences, engineering and the humanities and law and business to pioneer solutions for the world's most challenging problems.

In 2018, the university brought in over $800 million in research funding, disclosed 154 inventions and launched 14 startup companies.

The translation of research and innovation into commercially-driven social impact is being spearheaded by our newly recast Innovation and Technology Commercialization (ITC) division — one of five divisions within the Office of Research. ITC enables technology development, from conception to commercialization, by providing tools, services, resources and connections that empower our university's bold and imaginative researchers to make an indelible impact on the world.

Our team consists of two units: Innovation*Access* and Venture Catalyst. These teams work collaboratively to cultivate innovation, propel venture formation and invigorate technology commercialization and societal impact from university research. Working closely with entities and stakeholders within and outside the campus, ITC collaborates with faculty, students, staff, the Sponsored Programs Office, the Mike and Renee Child Institute for Innovation and Entrepreneurship, and the newly formed Foundation and Corporate Engagement unit within Development and Alumni Relations. Externally, ITC engages with service providers, investors, entrepreneurs, incubators, accelerators, government and policy stakeholders and stewards of regional economic development. We also work with industry partners focused on accessing university innovation and de-risked technologies.

In 2018, the university brought in **over $800 million in research funding**, disclosed **154 inventions** and launched **14 startup companies**.

Note: The values reported are preliminary estimates based on data at the time of publishing this report.

FUELING INNOVATION

UC Davis is recognized around the world for its strengths in research and innovation across the life sciences, physical sciences and engineering specialties. Our global contributions reflect our unbounded imagination and bold approach—bringing together engineers, clinicians, scientists, policymakers, researchers and business professionals to unlock new solutions to difficult problems.

ITC plays a critical role in enabling campus innovators to translate their research into commercial impact by providing targeted funding, protection of intellectual property and connections to the marketplace.

This past year, UC Davis researchers disclosed 154 inventions spanning a wide range of applications, with the majority relating to advancements in human health. Intellectual property officers within Innovation*Access* work closely with inventors and external attorneys to evaluate and manage intellectual property developed at UC Davis—with the ultimate goal of advancing new technologies that benefit society through commercial channels. During the past year, 164 new patent applications were filed and 98 new patents issued.

Innovation*Access* not only protects and manages intellectual property developed at the university—it facilitates the translation of these technologies into commercial impact by working closely with both established companies and startups seeking technologies for competitive benefit. As an example of our success in translating technologies, UC Davis contributed seven of the top 25 revenue-producing innovations within the University of California system during FY 2018. Innovation*Access* works in close collaboration with Venture Catalyst and the Sponsored Programs Office and engages with researchers at the earliest phases of their endeavors to identify and protect intellectual property and to encourage consideration of the commercial potential of their research.

GUIDING NEW VENTURES

One of the most exciting ways breakthrough technologies developed at the university reach the public is through startup companies. However, this can also be challenging due to multiple barriers, including funding, access to tools and resources and complex business and legal processes involved with going from precarious startup to established company.

In order to help university entrepreneurs overcome these barriers, the Office of Research established Venture Catalyst in 2013 to equip startups with the knowledge, connections and resources needed to succeed.

Venture Catalyst guides entrepreneurial researchers through the formation of startup companies, including the process of establishing the appropriate corporate structure, applying for patents that extend the company's foundational intellectual property, and making essential connections within the commercial sphere. Since its launch in FY 13–14, 85 startups have been formed, including 14 in the past fiscal year.

Startup formation has been facilitated through several initiatives developed and led by Venture Catalyst. Prior to startup formation, campus innovators are able to take advantage of the Science Translation and Innovative Research (STAIR™) Grant program, which provides funding to support proof-of-concept studies for new technologies with commercial potential. As technologies make progress in achieving pre-commercialization milestones, entrepreneurs can enroll in the Venture Catalyst Smart Toolkit for Accelerated Research Translation (START™) program. Entrepreneurs participating in the START program can receive deferment of patent expenses through the Inventor Advantage Program (IAP™); incorporation and startup legal support through the LegalNet™ program; access to networks of experienced industry professionals and mentors through the MentorNet™ program; a selection of vetted service providers through the VentureNet™ program; SBIR/STTR grant submission workshops; and sponsorship and support for participation in the UC Davis Institute for Innovation and Entrepreneurship's Entrepreneurship Academies.

Since its launch in FY 13–14, **85 startups** have been formed, **including 14 in the past fiscal year**.

To support the companies as they emerge from the university, Venture Catalyst has developed a launch platform that provides access to a network of thematically oriented startup incubators—both on and off campus—as part of the Distributed

Research Incubation and Venture Engine (DRIVE™) program.

Additionally, Venture Catalyst enables global innovation between university innovators and foreign early stage companies seeking access to UC Davis thought leadership and to Northern California markets through its Worldwide Accelerated Research Partnerships, or (WARP™) program.

Note: The values reported are preliminary estimates based on data at the time of publishing this report.

Research universities like UC Davis are a key source of vital innovation for numerous industries. Our role within the Office of Research is to empower the creativity and ingenuity of our researchers and help translate their innovations into commercial applications that help bolster our economy and improve quality of life. I would like to take this opportunity to thank Dushyant Pathak for his steadfast leadership of the Innovation and Technology Commercialization team over the last seven years. Dushyant's passion, knowledge and innovative approach have certainly elevated our impact in this regard.

PRASANT MOHAPATRA

Vice Chancellor for Research
UC Davis

The remainder of this report highlights specific examples of the programs and services provided by ITC along with their evidence-based social impact.

STARTUPS ENABLED BY

UC DAVIS INNOVATIONS

14 STARTUPS FY 18–19

85 STARTUPS SINCE FY 13–14

Digestiva

Engineering novel enzymes that enhance bioavailability of protein in food products

Seven Biosciences

Novel platforms for G protein-coupled receptor (GPCR) drug discovery

EFFECTOR BIO

Biomarker-based drug development, testing, and implementation for cancer and lung disease

DELIX THERAPEUTICS

Compounds for increasing neural plasticity

THERANOSTEC

Full/high active pharmaceutical ingredients loaded nano-platform

eVTi

Certified registry of birth certificates on Distributed Ledger Technology (DLT) private/public network

Bouncer

Software to help protect apps against fraud, account takeover, coupon abuse, and other product safety features

SIERRA biopharma

Peptides and uses thereof for diagnosing and treating myasthenia gravis

KEEN THERAPEUTICS

Fermented wheat germ extract and its purified low molecular weights proteins for treatment of lung cancer

GALACTMED

LLS30, a galectin-1 inhibitor, is a new potential drug against a number of different cancers

Syncanica

synthetic cannabinoids

Synthetic, inexpensive, non-scheduled cannabinoid for reducing the frequency and severity of seizures

AgriNerds

Data management and visualization tool built to address the needs of the agriculture industry

NanoCue™ Technology

Atomic force microscopy-based platform for investigating single cell mechanics

One company has elected to remain in "stealth mode" for competitive reasons and is not listed

INVENTIONS & PATENTS FY 18–19

Records of Invention 154

Total Patent Applications Filed 164

Total Patents Issued 98

Total Licenses Executed
(Plant and Utility; Exclusive and Non-Exclusive) 55

Combined Option & Letter Agreements Executed 21

Total Material Transfer Agreements Executed 814

Copyright Licenses Executed 186

Data Transfer Agreements Executed 84

Income from Royalties & Fees ..... >$10 MILLION

Note: The values reported are preliminary estimates based on data at the time of publishing this report.

FY 18–19
UC DAVIS RECORDS OF INVENTION BY CATEGORY

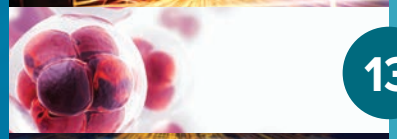
35 Human Therapeutics

21 Animal Health

19 Agriculture & Food Science

19 Human Diagnostic & Medical Device

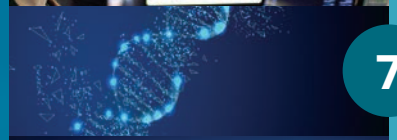
18 Engineering & Physical Sciences



13 Biological Sciences

9 Platform Tool/ Technology

7 Computer Science/ Software



7 Other

6 Energy, Environment, Sustainability & Transportation

UC DAVIS CHANCELLOR'S

INNOVATION AWARDS

The UC Davis Chancellor's Innovation Awards recognize faculty, community partners and industry leaders for their work, dedication and success in improving the lives of others and addressing the needs of our global society through innovations in technology or innovative societal engagement.

Venture Catalyst manages the awards program as part of its broader mission to foster an effective innovation ecosystem within and outside the university.

Scan the QR code or go to the web address below to see videos of the awards winners.

https://bit.ly/2JdThz2

Innovators of the Year

Jamie Peyton

Veterinarian Jamie Peyton was selected Innovator of the Year for her successful and groundbreaking use of sterilized tilapia skin to treat animals with burns. Peyton developed the technique to prepare and store the tilapia skin bandages, which are high in a collagen matrix that promotes wound healing while covering delicate nerve endings for almost immediate pain relief.

Michael Rogawski

Neurologist Michael Rogawski was selected Innovator of the Year for his groundbreaking research with allopregnanolone, also known as brexanolone. Earlier this year, brexanolone received Food and Drug Administration approval as the first and only specific drug treatment for women with postpartum depression.

Lifetime Achievement in Innovation Award

John and Lois Crowe received the Lifetime Achievement award for their pioneering work understanding how certain organisms are able to survive extreme dehydration using a simple sugar called trehalose. Those research findings have led to widespread innovations in pharmaceuticals, medicine and agriculture, and have been the basis for numerous products as well as companies geared towards saving lives and preventative health care.

Innovative Community Partner Award

The Sacramento Region Innovation Awards was the recipient of the 2019 UC Davis Chancellor's Innovative Community Partner of the Year Award. Founded by the law firm Stoel Rives, the awards program is run in three other regions in the country and executed locally in partnership with the public accounting firm Moss Adams. The awards program was selected for its role in showcasing and strengthening our region's innovation community.

ADVANCING

PROMISING TECHNOLOGIES

Managed by Venture Catalyst and funded by the UC Davis Office of Research, the STAIR Grant program provides funding to support translational science and innovative research performed by UC Davis researchers. The goal of the program is to demonstrate early proof-of-concept and commercial potential or feasibility for technologies being developed with the intent of commercial translation.

2018–19 STAIR Grant Recipients

Peter Havel

PROFESSOR, DEPARTMENT OF NUTRITION AND MOLECULAR BIOSCIENCES

Validation and Development of Natural Products as Triglyceride Lowering and Cardiovascular Protective Therapeutics

The protective effects of Mediterranean and Nordic diets against cardiovascular disease are well known, with many attributing the health effects to omega-3 fatty acids. Havel and his team will build on promising preliminary results from a pilot study demonstrating triglyceride-lowering effects of novel products found in natural sources such as plants and animals. The project will expand on this research to validate the impact of one or more lead compounds on circulating lipids/lipoproteins and other related metabolic biomarkers.

Stuart Meyers

PROFESSOR, DEPARTMENT OF DEPARTMENT OF ANATOMY, PHYSIOLOGY AND CELL BIOLOGY

A Novel Method to Improve Salmonid Aquaculture

There is increasing pressure on aquaculture companies to simultaneously increase productivity and become more ecologically and financially sustainable. Many fish species are hard to spawn, and it can be difficult to maintain genetic diversity and disease resistance in hatchery-produced fish. Meyers and his team are developing an innovative reproductive biotechnology tool for salmonid aquaculture to increase spawning efficiency and genetic diversity while eliminating the need for exogenous hormones. The STAIR Grant will enable the team to test the ability of the reproductive tool to create commercially sustainable single-sex populations of fish with a large number of different genetic lines.

Alyssa Panitch

EDWARD TELLER PROFESSOR, DEPARTMENT OF BIOMEDICAL ENGINEERING, AND EXECUTIVE ASSOCIATE DEAN, COLLEGE OF ENGINEERING

Therapeutic Development to Improve Outcomes Following Myocardial Infarction

Methods of revascularization and the restoration of blood flow to the heart after a blockage have increased survival rates but have also led to downstream issues of ischemia-reperfusion injury when blood flow returns to the tissue. Panitch and her team have developed a drug candidate with potentially protective effects for cardiac tissue that could improve morbidity and mortality following acute coronary syndromes. The team plans to do in vivo studies using mouse models to validate this treatment approach.

The STAIR Grant program is in its sixth year. With the funding in this cycle, the program has **awarded over $1.6 million to 30 recipients.** In total, STAIR Grants have enabled the creation of **11 UC Davis-associated startups.**

In 2019, thanks to the STAIR Grant program, **six recipients were awarded** a total of **$409,000 for FY 18–19:** $259,000 from the UC Davis Office of Research as well as additional financial support from the School of Veterinary Medicine, College of Biological Sciences, College of Engineering and Innovation Institute for Food and Health.

Jamie Peyton

CHIEF OF SERVICE, VETERINARY MEDICAL TEACHING HOSPITAL

Novel Fish Skin Bandages for Treatment of Partial and Full Thickness Wounds

There is an immediate need for the development of affordable, easily accessible and low-risk dermal substitutes for humans and animals. Peyton and her team have developed a tilapia skin xenograft for use in burn patients to alleviate pain and encourage rapid healing. Based on preliminary data obtained from veterinary patients with severe burns, the team's novel approach holds great promise for application, safety and efficacy as a product with broader applicability. Through the support of the STAIR Grant, the team plans to further validate and optimize their technology and methods.

Venkatesan Sundaresan

PROFESSOR, DEPARTMENT OF PLANT BIOLOGY AND DEPARTMENT OF PLANT SCIENCES

Developing Clonal Hybrid Seeds in Maize

Hybrid plants exhibit significantly higher yields compared to inbred varieties, an effect called "hybrid vigor." However, hybrids cannot be propagated sexually and must be generated annually by cross-pollination, which requires significant labor inputs and expense. Sundaresan and his team have developed a technology to make a hybrid plant that self-reproduces through seeds while maintaining its hybrid genetic constitution. They have demonstrated the technology in rice, and through the STAIR Grant project will work to adapt the technology for maize.

Allen Van Deynze

DIRECTOR OF RESEARCH AT THE SEED BIOTECHNOLOGY CENTER AND ASSOCIATE DIRECTOR OF THE PLANT BREEDING CENTER, DEPARTMENT OF PLANT SCIENCES

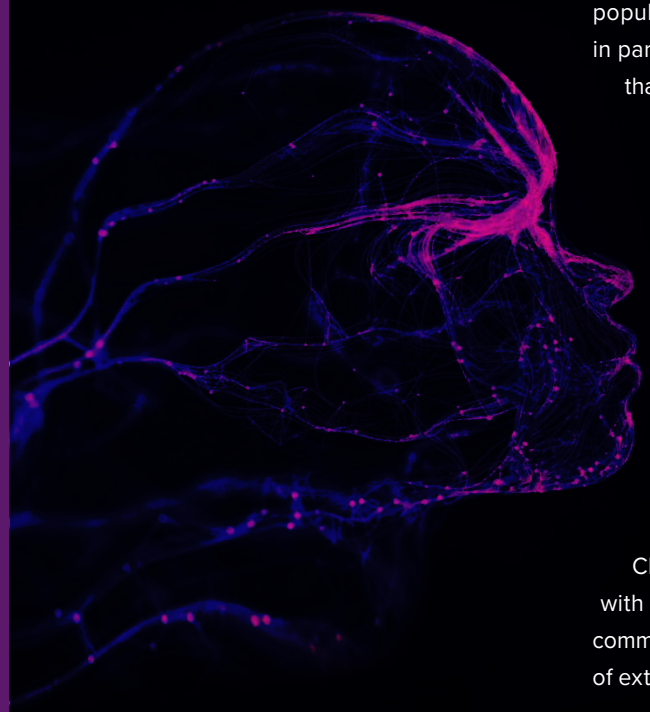
Enabling Mechanical Harvesting of Peppers

The majority of peppers are hand-picked, which is associated with a substantial labor cost. Van Deynze and his team have developed peppers that can be easily decapped and picked without the stem. They have developed destemming traits in peppers currently not deployed commercially that enable mechanical harvesting. With the STAIR Grant, the team plans to functionally verify the DNA markers they have identified and refine markers for the genes that control destemming to create mechanically harvestable peppers.

INVESTIGATING A BETTER

THERAPEUTIC FOR EPILEPSY

Syncanica Bio, a startup founded by professor Mark Mascal with support from Ph.D. graduate student Fei Chang, is investigating a synthetic cannabidiol (CBD) analogue as a novel therapeutic compound for conditions including anxiety, glaucoma and epilepsy.



Products containing CBD derived from cannabis or hemp plants have become popular for their potential health effects in part because CBD is less intoxicating than tetrahydrocannabinol (THC), the major psychoactive component found in marijuana.

Although the U.S. Food and Drug Administration in 2018 approved an oral CBD formulation for the treat-ment of some seizure conditions, CBD from extracts of cannabis or hemp poses legal problems in some states, as well as under federal law.

Mascal has developed an inexpensive synthetic alternative to CBD known as H2CBD — a molecule with a similar structure but made using commercially available compounds instead of extracts from hemp or cannabis.

H2CBD is non-intoxicating and easier to purify than the plant extract. It also eliminates the need to use agricultural land and irrigation for hemp or cannabis cultivation, avoids possible pesticide contamination and could circumvent the legal complications involved with cannabis-related extracts. Most importantly, unlike CBD, H2CBD cannot be converted to THC, eliminating the potential for abuse.

H2CBD was compared against herbal CBD in rats with induced seizures. H2CBD and CBD were found to be equally effective for the reduction of both the frequency and severity of the seizures. The work was published May 23, 2019, in the journal *Scientific Reports.*

Mascal is currently working with colleagues at the UC Davis School of Medicine to carry out additional studies in animals with the goal of moving into human clinical trials. UC Davis has applied for a provisional patent on anti-seizure use of H2CBD and its analogues.

HARNESSING AI / MACHINE LEARNING

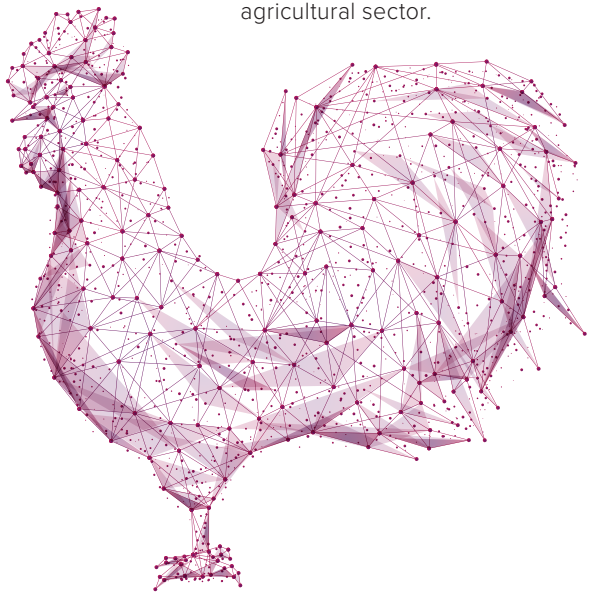
FOR AGRICULTURAL IMPACT

The agricultural sector is facing an enormous task—to increase food production to support the planet's explosive population growth. At the same time, the industry must address a growing number of food safety challenges associated with pathogenic bacteria like *Salmonella* and *E. coli*. These challenges are driving the need for and adoption of innovative solutions at the farm level, including remote sensing and robotics. However, utilizing these new technologies effectively requires the ability to clearly interpret and analyze the vast quantities of data being collected, which comes with its own set of challenges.

AgriNerds, one of 14 startups enabled in FY 18–19 by technology developed at UC Davis, is helping farmers harness the power of these technologies by providing a data management and visualization tool to integrate and interpret this information in real time. Their web-based application uses both machine learning and decision sciences to help farmers optimize production yield, food safety and operational efficiency.

The technology is based on the work of Maurice Pitesky from the UC Davis School of Veterinary Medicine-Cooperative Extension and former students Roberto Carrasco, Joseph Gendreau and Tristan Bond.

The team received proof-of-concept funding from the UC Davis Data, Informatics and Application Launch (DIAL™) Grant program from the Office of Research to develop and test the initial versions of the product. The startup is working with several poultry companies to further optimize their custom machine learning algorithms in order to expand operations throughout the agricultural sector.



DEVELOPING NOVEL TREATMENTS

FOR DEPRESSION AND RELATED DISORDERS

Delix Therapeutics, founded by David Olson, an assistant professor in the Department of Chemistry and the Department of Biochemistry and Molecular Medicine, is investigating whether neural plasticity–promoting drugs can lead to new treatments for depression, anxiety and related disorders.

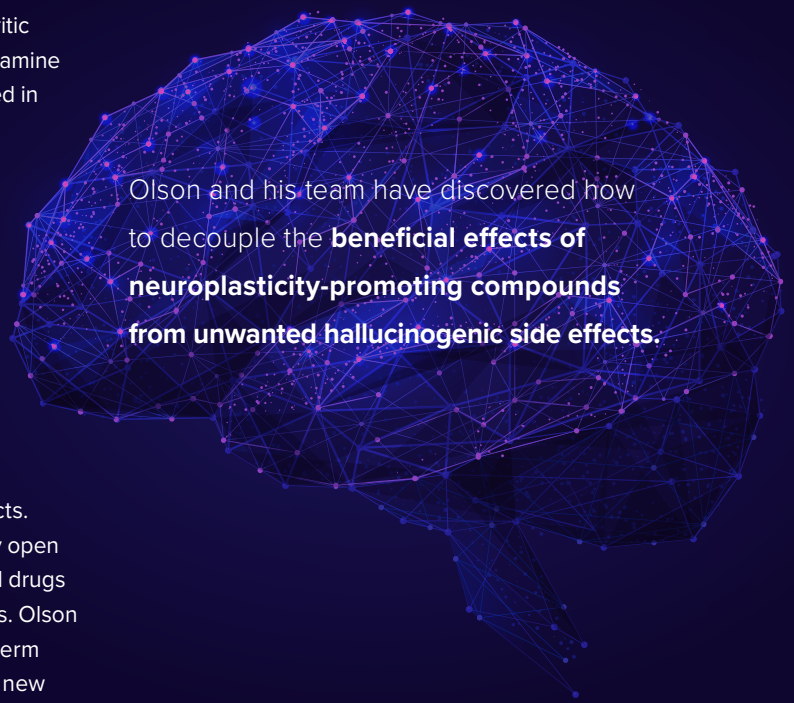
Atrophy of neurons in the prefrontal cortex of the brain is known to play a key role in depression and related diseases. The known antidepressant properties of ketamine, a dissociative anesthetic, may stem from its ability to promote neural plasticity–enabling neurons in the prefrontal cortex to rewire their connections.

In 2018, Olson and his team demonstrated that a wide range of psychedelic drugs, including well-known compounds such as LSD and MDMA (commonly called Ecstasy), increase the number of neuronal branches, the density of small protrusions on these branches (dendritic spines) and the number of connections between neurons. Rats treated with a single dose of DMT (N,N-Dimethyltryptamine), a psychedelic compound found in Amazonian herbal tea known as *ayahuasca,* showed an increase in the number of dendritic spines, similar to that seen with ketamine treatment. Their work was published in the journal *Cell Reports*.

While drawbacks of using compounds such as LSD and MDMA as therapeutics include their hallucinogenic and psychostimulant effects, in a significant development Olson and his team discovered how to decouple the beneficial effects of neuroplasticity-promoting compounds from the unwanted hallucinogenic side effects.

This discovery could potentially open doors for the development of novel drugs to treat mood and anxiety disorders. Olson and his team have proposed the term *psychoplastogen* to describe this new class of “plasticity-promoting” compounds.

The company is investigating several distinct novel chemical scaffolds and molecules capable of promoting plasticity in order to develop safer and more effective alternatives to treat depression and related disorders.



Olson and his team have discovered how to decouple the **beneficial effects of neuroplasticity-promoting compounds from unwanted hallucinogenic side effects.**

PIONEERING INNOVATIONS

IN AGRICULTURE

In 2017, geneticists from UC Davis sequenced the genome of *Coffea arabica*—a species responsible for 70% of global coffee production—with the goal of developing new high-yielding and high-quality varieties adapted to the stresses caused by climate change.

Progress from the research enabled the formation of a new company, Frinj Coffee, founded by Jay Ruskey, a farmer, and Juan Medrano, a professor and geneticist from the UC Davis College of Agricultural and Environmental Sciences, along with Andy Mullins and Lindsey Mesta. The company is pioneering the coffee growing industry in California, well outside the traditional tropical geographic belt closer to the equator.

In 2018, Frinj Coffee joined the UC Davis-HM.CLAUSE Life Science Innovation Center—part of Venture Catalyst's DRIVE network of incubators—to further develop novel coffee varietals that are adapted to grow within the specific soil and climate conditions of the state.

Frinj Coffee is providing coffee plants, consulting and post-harvest resources to over 40 new farms across Southern California—and has marketed coffee through Oakland-based roaster Blue Bottle Coffee, San Diego-based Bird Rock and premium international buyers.

PHOTOS: Juan Madrano, cofounder, and Marta Matvienko, lab operations and bioinformatics, breed coffee plants suitable for growth in California at the UC Davis-HM.CLAUSE Life Science Innovation Center in Davis, California.

OVERCOMING

POSTPARTUM DEPRESSION

On March 19, 2019, the FDA approved Zulresso™ (brexanolone) injection, a human therapeutic developed by Sage Therapeutics for the treatment of postpartum depression in women. Initial clinical studies of an intravenous formulation of allopregnanolone (also known as brexanolone) were conducted by Michael Rogawski, a professor in the UC Davis departments of neurology and pharmacology. UC Davis granted rights to Sage Therapeutics, including licenses to certain patent rights, for the commercial use of allopregnanolone.

This is the first drug approved by the FDA specifically for postpartum depression, which is the most common medical complication of childbirth and affects approximately one in nine women in the U.S. who have given birth.

Postpartum depression is a distinct and readily identified major depressive disorder that may have devastating consequences for a woman and for her family.

Allopregnanolone is a naturally occurring neuroactive steroid derived from the female sex hormone progesterone. Rogawski became interested in allopregnanolone as a potential treatment for postpartum depression because studies with neuroactive steroids conducted in his and other laboratories showed antidepressant potential.

In addition to licensed patent rights, Sage Therapeutics was granted a right of reference to the University of California's Investigational New Drug (IND) application package related to the use of allopregnanolone, which facilitated Sage's transition of allopregnanolone into the clinic. The university also made the allopregnanolone drug substance available for Sage's use in early clinical trials.

PHOTOS: Dorota Zolkowska and Michael Rogawski. Michael Rogawski, a professor in the UC Davis Department of Neurology, and Dorota Zolkowska, a project scientist in Rogawski's research laboratory, conducted studies resulting in inventions related to allopregnanolone as a potential treatment for neurological diseases. (Rudy Meyers Photography)

Rogawski and UC Davis project scientist Dorota Zolkowska are the inventors of U.S. Patent No. 10,251,894 B2, issued to the regents of the University of California on April 9, 2019, claiming methods of treating postpartum depression.

OTHER STARTUPS IN THE NEWS

Novoheart, a stem cell biotechnology company, entered into a strategic partnership with precision medicine company Xellera Therapeutics in order to build a good manufacturing practice facility and create clinical-grade human stem cell libraries.

Efficient Drivetrains, Inc., a company that designs and produces hybrid and fully electric drivetrain systems for commercial markets, was acquired by Cummins, Inc., a global leader in power solutions.

PvP Biologics, Inc., a company focused on oral enzyme therapeutic products, initiated two first-in-human clinical trials for Kuma062, a product candidate for the treatment of celiac disease, funded by the pharmaceutical company Takeda, which has an exclusive option to acquire PvP following completion of proof-of-principle studies.

BREEDING

BETTER STRAWBERRIES

The UC Davis Public Strawberry Breeding Program has been a huge success for California. Over the past six decades, the program has developed more than 30 patented varieties, made strawberries a year-round crop in California and boosted strawberry yield from just 6 tons per acre in the 1950s to 30 tons per acre today.

This impact is being extended around the world. Approximately 1 billion patented strawberry plants are planted worldwide each year. In 2018, the University of California entered into a master agreement with Global Plant Genetics, Ltd., (GPG) based in Norfolk, England, for the sublicensing of new strawberry varieties in selected countries within Europe, the Mediterranean region and South America. The agreement governs the commercialization of new varieties from the UC Davis Public Strawberry Breeding Program.

GPG will work with UC Davis researchers, plant nurseries and fruit producers to test the commercial potential of new strawberry varieties in these territories. If the parties agree to move forward with commercialization of a variety, GPG will implement and manage the variety's licensing to growers for fruit production, distribution and eventual retail sale.

"We are truly excited to be representing the world's No. 1 strawberry breeding program," says Rupert Hargreaves, director of GPG. "The quality of plant breeding, access to modern science, huge gene pool and impressive team of people give us confidence that varieties from this program will be at the forefront of international strawberry production for many years to come."

With this in mind, the university has significantly enhanced its Public Strawberry Breeding Program to enable development of the next generation of commercially successful strawberry varieties. GPG was selected by UC Davis because of the company's unique knowledge of the strawberry industry as well as its expertise in plant intellectual property management. The terms of any individual licenses under the agreement will be defined once the commercial potential of individual varieties has been determined.

COLLABORATING WITH INDUSTRY TO CULTIVATE

AGTECH INNOVATION

UC Davis researchers and entrepreneurs joined over 1,300 industry leaders at the World Agri-Tech Innovation Summit in San Francisco—with the goal of establishing new relationships to accelerate agtech solutions for transforming the food supply chain into a more sustainable, affordable and nutritious system. Attendees included business leaders, venture capitalists, technologists, startups and international organizations with expertise in the agtech arena.

UC Davis sponsored the Genomics and Translational Research track of the summit, leading discussions that included a deep dive into the next generation of breeding technologies, how to accelerate the development of innovation from pilot to full-scale commercial applications, an overview of the Earth BioGenome Project and a panel discussion highlighting ways corporate partners can engage effectively with universities to drive their commercial pipelines.

Select attendees were given a site tour of UC Davis—with stops at the Robert Mondavi Institute for Wine and Food Science, campus livestock facilities showcasing novel approaches to reducing methane emissions in dairy cattle and the UC Davis-HM.CLAUSE Life Science Innovation Center (part of the Venture Catalyst DRIVE network). The site visit also included a panel discussion highlighting the regional agtech innovation and entrepreneurship ecosystem.

PHOTO: Helene Dillard, dean of the College of Agricultural and Environmental Sciences and Howard-Yana Shapiro, chief agricultural officer at Mars, Incorporated, led a discussion on how university-industry collaborations are accelerating innovation from pilot to full-scale commercial applications.

Sponsorship of the event was made possible through the College of Agricultural and Environmental Sciences, Graduate School of Management, College of Biological Sciences, Innovation Institute for Food and Health, World Food Center and Office of Research.

ENABLING SUCCESSFUL PARTNERSHIPS

FOR UC DAVIS BIOTECH STARTUPS

Venture Catalyst offers several innovative programs that bridge the gap between early-stage research and commercialization by enabling and supporting robust university startups and spinouts. For instance, in 2018, the launch of the Biotech Innovation Gallery (BIG) Accelerator program provided guidance to 21 UC Davis biotechnology startups on business plan development, intellectual property strategy, regulatory strategy and investor pitching.

The three-month accelerator program culminated in the Biotech Innovation Gallery, which coincided with the J.P. Morgan Healthcare Conference in San Francisco. The event offered a platform for UC Davis innovators and entrepreneurs to showcase their emerging biotechnology companies and connect with industry experts, potential strategic partners and investors. Startup founders participated in more than 65 one-on-one meetings with these key players during the day, before networking with over 180 invited guests who attended the pitch event and reception. Ten of the startups participating in the program were ultimately selected by the Venture Catalyst team and industry advisors to deliver short investor pitches at a showcase event and networking reception held at the Weinstein Gallery in San Francisco.

HELPING STARTUPS FLOURISH

THROUGH INTERNATIONAL NETWORKS

The UC Davis Venture Catalyst Worldwide Accelerated Research Partnerships (WARP™) program enables and facilitates network connections for international startups looking to accelerate their businesses with an operating location in Northern California. The program provides companies and international startup accelerators with more efficient and targeted access to innovation networks and sources of capital within California. In addition to providing a soft-landing platform locally for international startups, the program also assists UC Davis-based startups looking to expand into foreign markets and access innovation networks globally.

The WARP program benefits the Davis-Sacramento region by enhancing regional innovation through new collaborations and providing students with unique opportunities to engage with startups through internships or employment. Venture Catalyst assists companies through connections with faculty members, research collaborators, students, incubator and research facilities, potential corporate partners and investors, service providers and economic development organizations. International startups engaging through the WARP program are also provided access to a suite of resources available through the START program.

One of the startups participating in the program, Botanical Solutions, is a Chilean startup accelerated through WARP program partner GaneshaLab. The company has developed a technology to produce a biofungicide derived from a plant native to Chile called *Quillaja*, which protects crops against *Botrytis*, often referred to as "gray mold." Botanical Solutions decided to move some of its operations to Davis following an introductory meeting with Venture Catalyst in Chile and an exploratory visit by the company to Northern California. The company is currently preparing for regulatory certification and a product launch in the U.S.

In 2018, a new agreement of cooperation was signed with the Montpellier University of Excellence (MUSE), a consortium of 19 partners led by the University of Montpellier, that includes national research organizations, hospitals and higher education institutions across France. This agreement supports the development of successful transnational collaborations between startup companies in the Occitanie region of southern France and the Davis-Sacramento region.

This new relationship builds upon existing agreements with:

- **Grid Exponential** (GridX), a technology startup accelerator in Argentina
- **GaneshaLab**, a biotech scale-up boutique accelerator in Chile
- **UC Davis Chile Life Sciences Innovation Center** in Chile

EXPANDING INNOVATION

AND ENTREPRENEURSHIP INITIATIVES

A one-time, $2.2 million investment from the State of California under Assembly Bill 2664 has enabled new and expanded innovation and entrepreneurship support initiatives at UC Davis—leading to cutting-edge technologies, products and companies.

The funds, which were approved in 2016 and released over a three-year period, spurred an additional $3.9 million in matching funds from external sources for a total of $6.1 million—extending opportunities for UC Davis innovations to spur economic development in the region and state.

Preliminary data show that over the three-year period, the new and expanded programs have directly enabled the launch of 30 startups, led to the development of 47 products and accelerated over 85 companies. These outcomes were driven by a collaborative framework managed by Venture Catalyst with 13 campus and community partners, providing over $1.25 million in proof-of-concept grants, mentorship and training to over 1,400 aspiring entrepreneurs, expansion of the DRIVE network of incubators and launch of the Biotech Innovation Gallery (BIG) Accelerator program.

Venture Catalyst was able to expand programs like the Worldwide Accelerated Research Partnerships (WARP) program, which facilitate connections for international startups to accelerate their companies and establish operating locations in Northern California. In addition, Venture Catalyst launched the Discounted Access to Research Translation Services (DARTS™) program, which offers startups competitive rates for accessing services and equipment through a network of 32 campus core facilities.

PHOTO: Fatma Kaplan and Karl Cameron Schiller, cofounders of Pheronym recently relocated from Florida to become a tenant in the UC Davis-HM.CLAUSE Life Science Innovation Center and participant in the Venture Catalyst START program.

CULTIVATING ENTREPRENEURS

AND LEADERS

Undergraduate student innovators looking to advance new technologies and start companies, receive support from a variety of programs and facilities across campus. Venture Catalyst has continued to expand its engagement with and support of these programs, providing students with education on intellectual property strategies, pitch coaching, connections to legal service providers for incorporation and introductions to investors—all as part of the START program.

This past year, Venture Catalyst engaged with over 30 new student teams looking to advance their solutions to market. Examples of startups launched by undergraduates who have since graduated, include Japa and Ravata Solutions.

Japa is a software startup that has developed a parking management platform. By using smart data and advanced analytics, it provides drivers with real-time parking information and lot managers with both real-time and advanced logistical information. Japa won the Sacramento Kings' Capitalize startup pitch contest as well as the 2018 UC Davis Big Bang! Business Competition. It has also secured a partnership with the Siemens Smart Cities initiative and has deployed its system at sites in the cities of Berkeley and Walnut Creek, California.

"Venture Catalyst has been helpful throughout our journey," said Mathew Magno, CEO of Japa. "They have helped us with so many things, from providing early stage advice and connecting us with experienced mentors, to setting us up with strategic partners and venture capital firms for potential investment."

Ravata Solutions created a device that automates embryo processing for transgenic mouse model development. The company recently identified trends in embryo quality that could serve as a platform with applications that include improving success rates in human IVF applications. Ravata was selected to participate in this year's Biotech Innovation Gallery (BIG) Accelerator program and is currently located in the Inventopia incubator facility, a member of the Venture Catalyst DRIVE network.

Startup Resources for Students

Student Startup Center

- Student Startup Center Makerspace
- Prototyping Labs and Startup Mentorship Accelerator (PLASMA) Program
- Entrepreneurship Certificate Program

Mike and Renee Child Institute for Innovation and Entrepreneurship

- Little Bang! Poster Competition
- Big Bang! Business Competition
- Entrepreneurship Academies
- Undergraduate Innovation + Entrepreneurship Workshop Series

Department of Biomedical Engineering

- TEAM Lab prototyping labs

Internship and Career Center

- Entrepreneurship Quest: Undergraduate Internship Program (EQUIP)
- Startup Career Fair

Venture Catalyst

- Smart Toolkit for Accelerated Research Translation (START) Suite of programs
- Distributed Research Incubation & Venture Engine (DRIVE) Program

"**Venture Catalyst has been helpful throughout our journey**," said Mathew Magno, CEO of Japa. "They have helped us with so many things, from providing **early stage advice** and **connecting us with experienced mentors**, to setting us up with **strategic partners and venture capital firms** for potential investment."

ADVANCING THE NEXT GENERATION OF

ENTREPRENEURS AND LEADERS

While our focus is on advancing technologies to drive economic impact and social benefit, we take great pride and pleasure in helping the many brilliant students that work with us along their professional journey.

An outstanding example of this is found in our very own Fei Chang, currently serving as the biopharma program coordinator for Innovation and Technology Commercialization. Chang graduated from UC Davis in 2017 with a Ph.D. in chemistry. As a synthetic organic chemist, he acquired more than six years of experience in renewable chemical synthesis and drug discovery. His graduate research focused on converting biomass into fuels, polymers and pharma/agrochemicals—with the thesis of finding sustainable alternatives to the non-renewable fossil fuel feedstock.

During his time at UC Davis, Chang took advantage of several unique opportunities that led him down an unexpected path toward a burgeoning interest in the intersection of science and business. This interest was cultivated by a one-year internship at GlaxoSmithKline as a medicinal chemist as well as participation in the Business Development Fellowship program at the Graduate School of Management.

After graduation, Chang was hired as the biopharma partnerships coordinator in the Office of Corporate Relations—in collaboration with the UC Davis Comprehensive Cancer Center—to help prospect for, cultivate and manage partnerships between the university and the biopharmaceutical industry. Through proactive outreach with industry and participation in a number of specific conferences and events, Chang showcased the university's unique institutional expertise, translational research and biotech startup portfolio. He also assisted life science startups with Small Business Innovation Research (SBIR) applications, intellectual property strategy and achieving business milestones.

Chang is the co-founder Furanica, Inc., which originated out of his graduate study projects dedicated to developing furan fatty acids as therapeutics for metabolic diseases. He is currently serving as the principal investigator of a National Institutes of Health SBIR grant awarded to Furanica to further study the biological activities of furan fatty acids.

"The great fit between my efforts as a university startup founder and my role within ITC has been tremendous and beneficial. **Having the opportunities to engage with faculty innovators across therapeutic areas and learn about their cutting-edge technologies has broadened my knowledge and understanding of a multitude of disease biologies**."

— **Fei Chang**, Biopharma Program Coordinator, Innovation and Technology Commercialization

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